



INTRODUCTION

This course integrates topics related to **Histology, Pathology, Embryology, Gross Anatomy, Radiology, Biophysics and Physiology**.

In this multidisciplinary course, students learn about organs and their functions. Embryology, histology, gross anatomy and physiology are integrated to emphasize the correlation between body structure and function and their clinical significance. The objective of this subject is to provide a better understanding of the structure and function of the normal human body as a basis for understanding pathology. Medical students will be able to integrate foundations of these topics by macroscopic morphology observation of main organs on the cadaver and on radiological images and by observation of the microscopic structure of a variety of human cells and tissues through digital images. Essential background for understanding clinical medicine related to each of the organ systems is emphasized in each of these systems. The subject is divided into several didactic units for each of the subsequent organ systems:

- Cardiovascular System
- Musculoskeletal System
- Respiratory System
- Nephron-urinary System

Course director: Dr. Javier Burguete (javier@unav.es)

Faculty:

- Dr. Burguete, [CV](#), Catedrático, Biophysics
- Dra. Cuadrado, [CV](#), Catedrática, Embryology and Anatomy
- Dr. Llombart, CV, Profesor clínico asociado, Anatomy
- Dr. de Andrea, [CV](#), Profesor Titular, Histology
- Dr. Varela, CV, Profesor clínico asociado, Physiology
- Dr. Vives, CV, Profesor clínico asociado, Physiology
- Dr. Mora, CV, Profesor clínico asociado, Physiology
- Dra. Ezponda, aezponda@unav.es, CV, Profesor clínico asociado, Radiology
- Dr. Bastarrika, bastarrika@unav.es, [CV](#), Catedrático, Radiology
- Dra. Arraiza, marraizasa@unav.es, [CV](#), Profesor clínico asociado, Radiology

Venue: Room 4E02

Module: I Morphology, structure and function of the human body

Topic: I.3. Anatomy and physiology

- **Type:** Basic
- 2nd Trimester
- **Language:** English
- Grade in Medicine
- 12 ECTS
- **Schedule:** please, check [here](#).

LEARNING OUTCOMES (Competencies)

LO1 – That students have shown themselves to possess and understand knowledge in an area of study that develops from general secondary education, and is usually at a level that, although requiring advanced textbooks, also includes some aspects that imply knowledge from the forefront of their field of study.



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LO3 – That students have the capacity to collate and interpret relevant data (normally within their area of study) in order to express opinions that include reflection on relevant subjects of social, scientific or ethical nature.

LO4 – That students can transmit information, ideas, problems and solutions to specialist and non-specialist audiences alike.

LO11 – To develop professional practice with respect to other health professionals, acquiring teamwork skills.

LO12 – To understand and recognize the structure and normal function of the human body at the levels of the molecule, cell, tissue, organ and system over the different stages of life and in both sexes.

LO14 – To understand and recognize the effects, mechanisms and manifestations of disease on the structure and function of the human body.

LO15 – To understand and recognize the causative agents and the risk factors that determine states of health and the development of disease.

LO16 – To understand and recognize the effects of growth, development and ageing on the individual and his or her social environment.

LO36 – To know about, to critically evaluate and to know how to use sources of clinical and biomedical information to obtain, organize, interpret and communicate scientific and health information.

LO47 – To know cellular structure and function.

LO49 – Metabolism.

LO50 – Metabolic regulation and integration.

LO51 – To know basic principles of human nutrition.

LO52 – Cellular communication.

LO53 – Excitable membranes.

LO58 – Embryonic development and organogenesis.

LO59 – To know the morphology, structure and function of the skin, the blood, and circulatory, digestive, locomotor, reproductive, excretory and respiratory apparatuses and systems; the endocrine system, the immune system and the central and peripheral nervous system.

LO60 – Growth, maturation and ageing of the different apparatuses and systems.

LO61 – Homeostasis.

LO63 – To manage basic laboratory material and techniques.

LO64 – To interpret normal laboratory analyses.

LO65 – To recognize the morphology and structure of tissues, organs and systems with macroscopic and microscopic methods and with imaging techniques.

LO66 – To carry out functional tests, to determine vital signs and interpret them.

LO67 – Basic physical exploration.

LO166 – Basic radiological semiology for the various apparatuses and systems.

LO167 – To know other techniques to obtain diagnostic images.



LO168 – To evaluate indications and contra-indications of radiological studies.

LO169 – To have the ability to apply the criteria of radiological protection during diagnostic and therapeutic procedures with ionizing radiation.

LO177 – To know the main indications for electrophysiological techniques (ECG, EEG, EMG and others).

LO179 – Scarring.

LO182 – Transfusions and transplants.

LO188 – To know how to interpret a radiological image by means of a systematic approach.

LO190 – To know how to obtain and interpret an electrocardiogram and an electroencephalogram.

PROGRAM

Musculoskeletal system

- Statics, balance, elasticity, traction, compression, shear, flexion, torsion
- Macroscopic and radiological anatomy of the vertebral column
- Macroscopic and radiological anatomy of the shoulder girdle and upper limb
- Macroscopic and radiological anatomy of the pelvis and lower limb

Cardiovascular system

- Main histologic and physiological features of the cardiovascular system: vessels and heart
- Embryologic development of the heart and the most frequent congenital anomalies
- Differences between fetal and postnatal circulation
- Anatomy of the heart and relationship with the pericardium: internal and external configuration of the heart.
- Radiological anatomy of the heart and mediastinum.
- Coronary circulation
- Innervation of the heart
- Conduction system of the heart: contraction of the cardiac muscle, cardiac cycle and heart sounds
- Heart electrophysiology and electrocardiogram
- Regulation of the cardiac cycle
- Circulation. Great vessels and hemodynamics
- Physiology of cardiac fibres; cardiac excitability.
- ECG Fundamentals
- Relationship between the cardiac cycle, the electrocardiogram and ECG recording.
- Cardiac auscultation and heart sounds.
- Arterial systemic circulation.
- Capillary circulation. Starling Forces. Venous return.
- Particularities of coronary circulation. Blood distribution in different peripheral regions and regional regulation.
- Control mechanisms in the cardiovascular system. Role of the autonomic nervous system. Short-term blood pressure control.
- Integrative review of cardiac physiology. Clinical cases.

Respiratory system

- Development of the respiratory system and the most frequent congenital anomalies.
- Anatomy and histology of the respiratory system and relationships with the pleural cavities. Innervation
- Radiological anatomy of the respiratory system.
- Introduction to respiratory physiology. Ventilation mechanics and dynamics.
- Pulmonary function tests.



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- Pulmonary ventilation. Mechanical properties.
- Pulmonary perfusion.
- Ventilation/perfusion ratio.
- Gaseous exchange.
- Gas transport.
- Regulation of the respiration.
- Pressure-volume curves.
- Transport of gases in blood.
- Alveolar Diffusion and O₂ transport to tissues.
- Control of pulmonary ventilation.
- Physiology of physical exercise. Physiological adaptations to physical exercise.
- Integrative review of respiratory physiology. Clinical cases.

Urinary system

- Development of the renal system and associated congenital anomalies
- Anatomy of the renal system and urinary tract
- Radiological anatomy of the renal system.
- Histology of the renal system
- Glomerular function, regulation of the glomerular filtration
- Tubular reabsorption and secretion
- The kidney as regulator of osmolarity: diuresis
- Regulation of water and electrolyte concentration.
- Acid-base physiology and disorders.
- Body fluid compartments: composition, concentration differences and distribution of water in the different compartments.
- Kidney functions and filtration mechanisms - glomerular functions.
- Kidney - Tubular transport and hormone-dependent functions I.
- ADH and aldosterone.
- Kidney - tubular transport and hormone-dependent functions II.
- ADH and aldosterone.
- Kidney - Mechanisms involved in water balance. Urination.
- Integrative review of renal physiology.

EDUCATIONAL ACTIVITIES

Lectures (100h): with the aim to provide a theoretical background of the main topics. It is not the objective to cover all the content of the subject, but to underline the most important points, help to assimilate the difficult issues and answer the students' questions. Flipped classroom methodology may be used. In any case, it is most relevant that the students work on the previously provided or proposed materials, to make the most of the ensuing activities in the classroom.

Team based learning sessions (10h) is a flipped classroom methodology that promotes active and dynamic learning. These sessions will be framed with clinical cases, so that through the development of clinical reasoning, the student may integrate the basic concepts in the clinical context. For the development of these sessions the students will be organized in groups.

Practical or laboratory sessions (12h) of biophysics, histology, physiology, radiology, and anatomy. The aim is to integrate radiological (radiographies, ultrasound, computerized tomography and magnetic resonance imaging) and gross anatomy. We will use biophysics problem solving, histological and radiological images, cadaver and dissection preparations. These activities will be done in small groups.

Personal study (170h):

- Previous work on the provided or proposed materials.
- Independent and self guided learning of virtual or on-line resources that allow the students to recognize the structures of histologic, radiologic and gross anatomy images.



- Study of the materials posterior to the in-person or on-line sessions.

Mentoring (5h): the teachers will be available for personal on-line or face-to-face tutorials with the students

Evaluation (6h): two final exams to assess the accomplishment of the course objectives.

ASSESSMENT

ORDINARY CALL

Formative evaluation:

The objective for the student is to develop clinical reasoning and long-term content acquisition.

Questions will be posed throughout the course with an increasing grade of complexity, helping the student integrate the contents of the subject.

Self-assessment: These questions will be answered independently before the lectures through the ADI examiner / Socrative / Wooclap.

Questions may be posed also during the sessions.

Summative evaluation (over 11 points)

Continuous formative assessment (10%): through the ADI examiner and Socrative (during the lectures and TBL sessions). Assessment of student's progression and learning will be made throughout the course.

Final exam (85% of the final mark): comprises 2 sections:

Test of 125 multiple choice questions (70%). They may include histological, radiological and gross anatomy images. There will be 4 possible answers. Wrong answers will discount 0.33%.

Short writing questions, biophysics' questions, drawing questions of anatomy (30%)

Practical exam (15%):

- Osteology Exam: 5% (11/12/2024)
- Identify elements on histologic images, on the cadaver, anatomic preparations or radiological images (10%) (to be taken at or near the final exam)

Requirements:

To pass the exam, the students must have a minimum of 50% of the final exam. This final examination has two distinct parts: 1) Musculoskeletal System and 2) Cardiovascular, Respiratory and Nephro-Urinary System.

A mark of at least 3 is required in each of the systems in the test of multiple choice questions. Also, a 3 is required in the practical exam, to pass the course.

Students who have failed the subject in the first call, but have passed (grade greater than or equal to 5) one of the two parts (musculoskeletal or cardiovascular-nephroureinary-respiratory), may be evaluated (both theoretical and practical) in the second call only for the part that they have failed.

The mark of the part approved in the first call will be saved to calculate the final mark of the second call.

The student can waive this option and be evaluated for the entire course, if they prefer.



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In no case will the mark of the part approved in the first call be reserved for the third or subsequent calls.

EXTRAORDINARY CALL

The students that do not pass the course in the ordinary call, will be assessed in the extraordinary call.

The extraordinary evaluation will be a single multiple-choice test (90%) that includes all the systems and a practical gross anatomy exam (10%).

Continuous assessment will not be taken into account and there will be no short questions.

There will be no other type of new evaluation after this extraordinary evaluation.

OFFICE HOURS

Attention to the student will be by appointment through the teacher's email:

Prof. Dr. Javier Burguete (Course Director) javier@unav.es

Prof. Dr. Gorka Bastarrika bastarrika@unav.es

Prof. Dr. Carlos de Andrea ceandrea@unav.es

Prof. Dr. Mar Cuadrado mcuadrado@unav.es

Dr. Ana Ezponda aezponda@unav.es

Dr. Rafael Llombart rlombartb@unav.es

Dr. Nicolás Varela nvarela@unav.es

Dr. Marc Vives mvives@unav.es

Dr. José María Mora jmora@unav.es

Dr. María Arraiza marraizasa@unav.es

BIBLIOGRAPHY AND RESOURCES

CELL BIOLOGY and HISTOLOGY

- Kierszenbaum A.L. & Laura Tres L. Histology and Cell Biology: An Introduction to Pathology. 5th ed [Find it in the Library](#)

- Mescher A.L. Junqueira's Basic histology: text and atlas. 14th ed. 2016 (English version) [Find it in the Library](#) (e-book)

- Essential reading will be made available by the course instructor.

- Histology and Virtual Microscopy at the University of Michigan. Learning Resources: <http://histology.med.umich.edu>

BIOPHYSICS



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- Jay Newman. Physics of the Life Sciences. Springer. 2008. [Find it in the Library](#) (e-book)

Advanced:

- R.K. Hobbie, Intermediate Physics for Medicine and Biology, Springer. [Find it in the Library](#)

- Irving P. Herman. Physics of the Human Body. 2nd Edition, Editorial Springer, 2016. [Find it in the Library](#)

EMBRYOLOGY

Moore y Persaud. The developing human. 11th ed.. Ed. Elsevier (2020) [Find it in the Library](#) (e-book)

Carlson. Human embryology and developmental biology. , 6th ed., Ed. Elsevier (2014). [Find it in the Library](#) (e-book)

ANATOMY

To study this course you will need:

- 1) a manual of Anatomy
- 2) an atlas of Anatomy
- 3) the Nomina Anatomica, and
- 4) a manual of Embryology

1. Recommended Manuals:

- Drake et al. Gray's Anatomy for students. 3rd ed. Ed. Elsevier (2020) [Find it in the Library](#)
- Moore, Dalley & Agur. Clinically oriented Anatomy, 8th ed. Ed. Wolters Kluwer (208). [Find it in the Library](#)
- Gilroy. Anatomy. An Essential textbook. Ed. Thieme (2017). [Find it in the Library](#)

2. Atlas (any of the following):

- Netter. Atlas of Human Anatomy. 7th ed. Ed. Elsevier (2019). [Find it in the Library](#)
- Gilroy et al. Prometheus. Atlas de Anatomía. 2nd ed. Ed. Thieme (2014) [Find it in the Library](#)
- Sobotta. Atlas de Anatomía Humana. 19th-23th ed. Ed. Panamericana. [Find it in the Library](#)

3. Nomina Anatomica:

- Dauber. Pocket Atlas of Human Anatomy, 5th revised ed. Ed. Thieme (2006) [Find it in the Library](#)

4. Manuals of Embryology (any of the following):



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- Moore, Persaud. The developing human: clinically oriented embryology, 11th ed. Ed. Elsevier (2020) [Find it in the Library](#)

- Sadler. Langman's Medical Embryology, 14th ed. Ed. Wolters Kluwer (2019). [Find it in the Library](#)

- Carlson. Human Embryology and developmental biology, 6th ed. Ed. Elsevier (2019). [Find it in the Library](#) (e-book)

Self-evaluation:

- Loukas y cols. Gray's anatomy review. Ed. Elsevier

RADIOLOGY

- Fleckenstein P. Anatomy in diagnostic imaging. [Find it in the Library](#) (e-book)

- Weir J. Imaging Atlas of Human Anatomy. [Find it in the Library](#) (e-book)

PHYSIOLOGY

- Costanzo LS. Physiology. 7th ed. Editorial Elsevier. This book is straightforward and can be useful to understand the basic concepts of physiology. [Find it in the Library](#)

- Koeppen BM and Stanton BA. Berne and Levy Physiology. 8ª Edición. Editorial Elsevier. This book is more extensive and complete than the previous. It may be used to deepen in some specific topics. [Find it in the Library](#)

The materials created by the teachers may be found in the Contents section.